Claims

1. A quantum-dot LED comprising:
a substrate;
a n-type semiconductor layer formed on the substrate;
an insulator layer formed on the n-type semiconductor layer and provided with a plurality of holes;
quantum dots formed by filling the holes; and
a p-type semiconductor layer formed on the insulator layer in which the quantum dots are formed.

2. A quantum-dot LED comprising:
a substrate;
a n-type semiconductor layer formed on the substrate;
a first insulator layer formed on the n-type semiconductor layer and provided with a plurality of holes;
quantum dots formed by filling the holes;
a barrier layer formed on the first insulator layer in which the quantum dots are formed;
a second insulator layer formed on the barrier layer and provided with holes and quantum dots like the first insulator layer;
a p-type semiconductor layer formed on the second insulator layer.

3. The quantum-dot LED according to claim 2, wherein the first and second insulator layers formed interposing the barrier layer therebetween has a multi-layer structure.

4. The quantum-dot LED according to claim 2 or 3, wherein the barrier layer is of one selected from the group consisting of GaN, GaAs and GaP.

5. The quantum-dot LED according to claim 1 or 2, wherein the holes are a nano-hole.

6. The quantum-dot LED according to claim 1 or 2, wherein the holes have a size range of 1 nanometer to 100 nanometers.

7. The quantum-dot LED according to claim 1 or 2, wherein the quantum dots are formed from one selected from the group consisting of InGaN, InGaAs and InGaP.

8. The quantum-dot LED according to claim 1 or 2, wherein the quantum dots comprise an upper surface being in contact with the p-type semiconductor layer, and a lower surface being in contact with the n-type semiconductor layer.

9. The quantum-dot LED according to claim 1 or 2, wherein the size and/or density of the holes are/is determined by deposition time of the insulator layer.

10. A method for fabricating a quantum-dot LED, the method comprising the steps of:

forming a n-type semiconductor layer on a substrate;

depositing a first insulator layer having first holes on the n-type semiconductor layer;

filling the first holes of the first insulator layer to form first quantum dots; and

depositing a p-type semiconductor layer on the first insulator layer in which the quantum dots are formed.

11. The method according to claim 10, further comprising the steps of:

(a) after the step of forming the quantum dots, forming a barrier layer on the insulator layer in which the quantum dots are formed;

(b) forming a second insulator layer having second holes on the barrier layer; and

(c) filling the second hole of the second insulator layer to form second quantum dots,

wherein the steps (a), (b) and (c) are repeated at least once.

12. The method according to claim 10 or 11, wherein in the step of depositing the insulator layers, the size and/or density are/is determined by deposition time of the insulator layer.